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ABSTRACT

This paper argues that it is important to provide children with complementary activities in a horizontal arrangement in order to promote acceleration of vertical levels of thinking. A brief review of literature on the relationship between experience and logical thinking is presented and the definition and function of transfer are discussed. Specific suggestions for teachers on how to facilitate environments that provide mechanisms for the development of problem solving skills are offered in five concept areas: (1) patterning, (2) comparison, (3) categorization, (4) prediction, and (5) hypothesis formation. (JMB)

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EXPERIENCE AND TRANSFER: STEPS TO COGNITIVE THINKING IN YOUNG CHILDREN

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Is there a relationhsip between experience and logical thinking in young children? Two important points emerge immediately from an examination of this question: First whatever experience undergirds such development, it is in all probability very broad, nonspecific, and unstructured in a child's natural environment. The development of logical thinking is a universal happening, that can be relied upon to take place. Second the fullness and richness of this development may be influenced by a variety of particular settings.

The theorists of the 1960's and 1970's have given special attention to the second phenomena. The research over the last one and a half decades had its roots in a developing body of theory (Hebb, 1949), and the investigations of the 1950's pointing to the beneficial effects of early and varying stimulation both in animals and humans (Bronfenbrenner, 1968). The implications of this work for early childhood education were developed in a highly influential book by Hunt (1961) that validated the notion of plasticity of intelligence and demonstrated the power of "the match" in learning. "Match" is defined as learning in a relationship of congruity to a slight incongruity, at the point between already-mastered learning and new learning the child has yet to master. These studies did not refer to general academic knowledge in the sense of computational or communicative skills, but instead to an understanding of conceptual

relationships, and thus have a direct bearing upon the acquisition of logical thought. Additional support comes from the work of Kagan (1971) and Torrance (1976), who suggest that the critical element in thinking is to derive a solution for a current problem when no known solution exists, by basing the new solution past experience. It is similar to the notion of horizontal transfer explicated by Wohwill (1970) who explains that the transfer of problem solving skills is a major component in the environment facilitating concept learning. Elkind (1974) verifies the same idea, although he labels it horizontal elaboration.

The syntheses to be made from these studies is that the quality of experience is a key factor in the development of logical thinking. And the quality of that experience can be enhanced when one gives attention to something that may be referred to as the transfer of problem solving skills or horizontal transfer. However, research (Goodlad, 1970; 1973) indicates that "behind the classroom door" little effort and attention is given to the development of problem solving skills as an important curriculum component for young boys and girls.

It is not our contention in the following paragraphs that we are presenting a new idea. However, based upon wide ranging observation of what is taking place in teaching and learning situations for young boys and girls, it is our concern that all adults maintain the notion of experience and transfer at the highest level of conscious awareness.

The Function of Transfer

To increase or enhance a child's cognitive thinking ability, and thus his capability with logical thought, a teacher must realize that all educational practice, independent of its degree of acceptance or level of concern, has its inception in theory. Concept learning is predicated upon the transferability of information, but not in a single vertical strand as though one were teaching a specific concept, as for example, the many attempts at teaching children to conserve. Instead it depends upon broad ranges of horizontal transfer. A parent and/or educator should strive to facilitate "horizontal development," that is, to develop learning opportunities that cause the child to use his current skill and knowledge in many related but different problem solving areas. Unfortunately there is a widespread misunderstanding about how children learn that suggests the vertical acceleration of mental abilities is more effective in cognitive growth than is horizontal transfer, when just the opposite is likely to be the case. For as Elkind (1974) states the situation:

> "In contrast, it seems to me that both parents and teachers do not provide sufficient materials for the horizontal elaboration of abilities on a variety of different materials. What generally happens is that once a child learns, say, to recognize circles or squares, the adult wants him to go on to new things. While in fact, seeing all the possible circles and squares about in the work-a-day world is a necessary way for establishing these concepts and for preparing the child to integrate such concepts to form a higher level concept such as "geometric forms." In general, a child who elaborates the skills he does have, such as the ability to order materials according to size, on a wide range of different materials

> (blocks, sticks, dolls, dogs, and so on), is likely to be better prepared for future learning than a child who has learned a great deal in a short time but who has not really had the opportunity to assimilate and practice what he has learned."

Siegel's (1972) investigation of learning classification skills supports the function of horizontal transfer. He taught young children the related skills of grouping, application of verbal labels for grouping, and wider basis for groupings and for relational responses. By increasing practice with these skills he was able to improve horizontal transfer in problem solving situations. The outcome was an increase in knowledge about higher levels of classification. Siegel hypothesizes that classification is an important antecedent of logical thought. Ultimately as explained by Wohwill (1970), it is the increasing complexity of horizontal transfer that promotes or accelerates vertical levels of thinking. Wohwill's (1970) experiments involve the function of measurement in a variety of forms such as length, area, distance, and vertical height as contributors to the learning of conservation. While the data for any single testing of any one of these forms of measurement show only a marginal correlation between measurement and conservation, a much stronger relationship exists when all four forms of measurement are taken into account on a pretest, intervention (teaching for measurement), post-test design. The research lends support for the hypothesis that vertical acceleration or learning of a specific concept, such as conservation, is generalized from the learning of many less difficult concepts, and skills like the various forms of measurement.

The above research indicates that complementary activities in a horizontal arrangement provide the transfer necessary to move to higher levels of cognitive thinking. It is also apparent that the difference in what children can learn at v rying stages of development is not content amount per se, but the extent of horizontal transfer, applying knowledge from one idea to another similar idea. The curricular implication is that logical thinking is not developed in situation-specific conditions, but instead when children have many broad experiences that provide opportunities for the transfer of information and problem-solving skills.

A Definition:

Children may be given certain learning assignments or even take for themselves certain concepts to be learned or tasks to be mastered. Each task is composed of vertical steps leading to the goal. However, the greater the step separating previously learned concepts or skills from the desired new learning, the greater is the amount of effort required to achieve the goal. As described in terms of "the match" in learning the larger the incongruity between old learning and new learning the more difficult it is to accomplish the new learning. Another factor is the number of vertical steps a learner must accomplish to reach his goal. When there are many steps there will be a narrow span of generalization or horizontal transfer overwhich the learning will occur. To state this another way - the greater the horizontal transfer the smaller in size and the fewer in number are the steps required to reach the goal.

In essence we teach concepts and skills that are indirectly related to the new goal in order to reach the new desired learning. Thus, Siegel taught children grouping skills and systems in order for them to transfer grouping skills to the solution of classification tasks. Wohwill taught children a variety of measurement skills and discovered a relationship to conversation skills. The primary function of logical thinking are to allow the child "1) to recognize the past, 2) to understand new experience, and 3) to manipulate his symbols, concepts and rules in order to solve a new problem" (Kagan, 1971, p. 189). Slowly knowledge develops on a broad but narrowing base, similar to a pyramid, until the understanding of a new and more difficult concept is achieved. Previously cited research and theory suggest teaching for horizontal transfer will facilitate the learning or understanding of higher level concepts. Therefore, an environment for young children should provide: 1.) many experiences that allow for transfer of information; 2.) experiences that are truly experiential in nature; and 3.) experiences that require the transfer or use of similar problem solving skills.

Environments which fulfill the requirements mentioned above may clearly be designed through the unique opportunities provided by learning activities that allow children to work with an array of materials and strive for new learning through the congruent - incongruent level of the task. However, to facilitate transfer, the center must not be a simple, single activity. Many activities are required, all complementary to the desired outcome, with each activity having its own clear and inherent objective.

An Example:

One of the complex concepts which young children learn through interaction with their natural environment is multiple categorization (Lavatelli, 1970). Children learn this concept through experiences with many materials in problem solving situations. Multiple categorization provides a good example of how a teacher or parent can create an environment to support the learning of difficult concepts. To create a multiple categorization a child must identify and categorize an object or symbol on two or more properties. For example, the following five classes of concepts provide an illustration of how an environment can be structured to produce the horizontal transfer required to learn the concept multiple categorization. The classes of concepts are: 1.) patterning - the discovery of a repetitive system, from which the child develops appropriate responses; 2.) comparison (including sorting and grouping) - discovery of differences and similarities among classes of objects, based on physical properties; 3.) categorization - discovery of inference based on comparison; 4.) prediction - discovery of implications of previous experiments; 5.) hypothesis formation - discovery of propositions leading to new concept investigation. These concepts relate to multiple categorization in a manner that is similar to the way measurement relates to conservation in Wohnwill's experiments, and grouping skills relate to classification in Siegel's research.

We do not suggest the concepts referred to in the example are the only ones useful for teaching the transfer of problem-solving

skills. Instead, we believe it is teachers' familiarity with them that makes them useful as an example. It is important to note that concepts are not learned only in science or mathematics centers, but also in music, art, language, physical activity, block building, and dramatic play centers or activities as well. The desired intent of the teacher should be to provide young children with experience that is highly structured, but that appears to be very broad, nonspecific and unstructured. We agree with Llkind (1974, p. 55)) that once a concept is learned children should not be required to go onto new things, but be allowed to consolidate that learning in a variety of settings and conditions.

A look at some practical features in each of the five concept classes may be helpful in facilitating environments that provide mechanisms for the development of logical thinking. It is important to realize that the mentioned activities are not single, concerted endeavors, but that all must be considered in order to provide maximal horizontal transfer value and thus generate knowledge and skill with multiple categorization.

Activities to Promote Patterning

.auditory rhythmic stimuli - clapping, tapping whistling, drumming

.visually repetitive shapes and colors, making a design with objects, use of a grid or peg boards

.identifying points of daily environmental routine - getting up, dressing, eating breakfast, time of day, and the like

The basic function of patterning is to help the child to observe the world's physical and logical conditions. Patterning is functional to auditory and visual discriminatory skills found in comparison, as well as in reading and computational skill.

Activities to Promote Comparison

Distinguish the difference between or similarity among:

SIZE

· bigger	-	smaller
· taller	-	shorter
· fatter	-	thinner
· heavier	-	lighter

TEXTURE

· rougher	-	smoother
· softer	-	harder
· thicker	-	thinner

SHAPE

· flat	-	not flat
· square	-	not square
· straight	-	not straight
· painted	-	not painted

COLOR

· lighter than	-	darker than
· same	-	different

GENERAL COMPARISON

· above	-	right
· below	-	shallow
· behind	-	deep
· in front	-	over
· in back	-	around
· left	-	same
· more than	-	different
· less than		

Comparisons are particularly important in the prenumber phase of arithmetic understanding, such as in set theory. However, they are also instrumental in providing horizontal transfer within concepts that lead to logical thought.

Activities to Promote Categorization

Categorizing similar objects into more than two groups on the basis of:

- size
- color hue
- texture
- weight
- shape

- from a group of mixed objects create a category on the basis of similarities.
- create a classificatory scheme of at least three groups from similar objects
- categorize from substance, attribute and function.

The purpose of the categorization process is to help the child perceive inferences for the purpose of problem solving. Categorization is a finer discrimination than patterning or comparison, and transfers horizontally to prediction and hypothesis formation.

Activities to Promote Prediction

Predicting outcomes on the basis of previous experience and knowledge:

- What sinks, what floats?
- What will the magnet pick up?
- Which is heavier (lighter)?
- What is inside the apple?

- If Daddy found your lost dog, how would you feel?
- How did Miss Muffet feel when the spider found her?

The purpose of prediction is to afford the child an opportunity to make guesses of estimates based on learnings that will foster eventual hypothesis building, and testing. This step is essential in the development of logical thinking because a child must be able to pose questions before inferring answers.

Activities to Promote Hypothesis Formation

Making statements about a conclusion by investigating:

- Water, ice, steam
- Baking experiences in which the ingredients are altered in form and substance.
- Wood, clay, play dough, sticks
- Running water and sand
- Predictable environments, routines, sequences of external cues.

Based on prior knowledge, the child seeks to test his or her environment, determining the logical consequences of action and thought.

By no means should the above list be considered all-inclusive. It is merely a representative model that may provide some directional clues. Many parents, teachers, and other adults can attest to the success of such measures based upon the child's interaction in his or her natural environment. Previous research and theory Blank and Solomon (1968, 1969) is also supportive of similar approaches to teaching. Therefore, these proposed activities should not be considered new or radical. In fact, careful observation would indicate that such

activities as these are common to all young children, and do indeed generate very productive learning.

From Piaget's (1937) research comes support for the idea that a young child's learning style requires him to experience the environment by sensory motor manipulation and also by actually perceiving what is happening. This is what Piaget (1967) later refers to as operating upon the environment to bring about change. The young child views the world in a subjective, egocentric manner, he is not yet fully aware of physical laws of logical consequences. However, he slowly acquires such knowledge when provided experiences that permit him to act on materials and ideas. Preschool children learn many concepts through active involvement with the environment, always generating problems to be solved. Therefore it is crucial for the young child to be involved in experience through which his or her thinking and learning style is given full range of expression. The major concluding point is, that there exists today a body of knowledge supported by research that indicates thinking skills can be taught when the situation emphasizes activities of a differing but related nature. Such activities allow the child to use past experience when selecting the proper solution of a new problem from an array of current alternatives.

In summary then it is not our contention that we are stating a new idea. However, we do think that people who are in a teaching role should keep the notion of problem solving skills and the means to effect their transfer at a level of conscious awareness. Sadly this

does not seem to be the case (Goodlad, 1970; 1973 and Elkind, 1974). Nonetheless their is evidence (Hunt, 1961; Wohwill, 1970; Kagan, 1971; Siegel, 1972 and Elkind, 1974) to support the conclusion that adults who work with children should be open and receptive to the learning styles of young people, therefore capitalizing upon the child's motivation to explore, manipulate and discover. Activities that closely parallel a child's natural inclinations toward learning afford the greatest opportunity to maximize his potential for logical thinking.

REFERENCES

Blank, M. and Solomon, F.A. A Tutorial Language Program to Develop Abstract Thinking in Socially Disadvantaged Preschool Children. Child Development, 1968, 39(1) 379-390.

_____ "How shall the Disadvantaged Child be Taught," Child Development, 1969. 40(1), 48-61.

Bronfenbrenner, Urie. "Is Early Intervention Effective." In Guttentag, Marcia (ed), Handbook of Evaluation Research, Vol. 2 Sage Publications, Beverly Hills: 1975

Elkind, David. "Piagetian and Psychometric Conceptions of Intelligence." Harvard Education Review, 39, 1969.

_____, Children and Adolescents, 2nd ed. Oxford Press, New York: 1974.

Goodlad, J.I. and Klein, M.F. Behind the Classroom Door. Jones Publishers, Worthington, Ohio, 1970.

Hebb, D.O. The Organization of Behavior. Wiley, New York: 1949.

Hunt, J. McVicker. Intelligence and Experience, New York: Roland Press, 1961.

Kagan, Jerome. "Preschool Enrichment and Learning" in Revisiting Early Childhood Education, J. Frost (ed.) Holt, Rinehart and Winston, New York: 1973.

Lavatelli, Celia S., Piaget's Theory Applied to an Early Childhood Curriculum. Boston: Center for Media Development, 1970.

Piaget, Jean. Six Psychological Studies. New York: Random House, 1967.

_____ "Principle Factors Determining Intellectual Evolution from Childhood to Adult Life," in Harvard Terrentenary Conference, Factors Determining Human Behavior. Cambridge, Harvard University Press, 1937.

Siegel, Irving. "The Development of Classificatory Skills in Young Children," The Young Child, Vol. 2, Washington, D.C.: NAEYC, 1972.

Torrance, Paul. Personal Communication, (Faculty Symposium) Texas Tech University, November, 1976.

Wolhwill, Joachim. "The Place of Structured Experience in Early Cognitive Development," Interchange, Ontario Institute for Studies in Education, Toronto, Canada, 1970.